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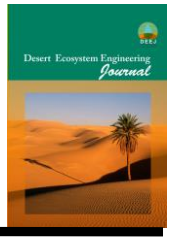

Simulating and Predicting Climate Change in Mangrove Forests of Hara Biosphere Reserve

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Extended Abstract

Introduction: Global warming has disrupted the climate balance in recent decades, causing extensive changes in different regions worldwide. In other words, climate change has influenced all biological processes by changing the temperature, precipitation, and other climatic variables' patterns, leading to alterations in the ecosystem's function and biodiversity loss, especially in dry and semi-arid regions. On the other hand, climate change is regarded as a main threat to mangrove forests, bringing about consequences such as increased sea levels, the occurrence of sea storms, alterations in precipitation patterns, increased temperature, and decreased coverage area of mangrove habitats. Therefore, simulating and predicting the prospective changes in the climate of mangrove forests can offer valuable suggestions for controlling the adverse effects of climate change and reducing the vulnerability of such natural ecosystems.

Materials and methods: This study sought to simulate precipitation, and minimum, maximum, and average temperature rates in the mangrove forests' biosphere reserve throughout the observation period (1996-2022) and the future period (2022-2050) using the data collected from the HadCM3 General Circulation Model (GCM) and the SDSM under RCP2.6 and RCP8.5 scenarios. In addition, the De Martonne method was used to identify the climate of the study area during the observation and future periods.

Results: A comparison of the results obtained for the observation and the baseline periods (1996-2022) indicated that the obtained values of the investigated climatic parameters enjoyed great accuracy, with the highest and lowest levels of model validation belonging to the average and maximum temperature rates, respectively. Furthermore, the predictions made for temperature changes for the 2022-2050 period, as compared to the 1996-2022 period, suggested that the average temperature would rise under both the RCP2.6 and RCP8.5 scenarios. Additionally, the results indicated that the area's maximum and minimum temperature rates would experience the highest increase, particularly in July. On the other hand, the results showed that the average precipitation would decrease throughout the 2022-2050 period in the Hara biosphere reserve under RCP2.6 and RCP8.5 scenarios, with the highest and lowest decreasing trends of precipitation belonging to January and July under the RCP2.6 scenarios and the RCP8.5 scenarios, respectively. Furthermore, according to the results obtained from the De Martonne aridity index, the climate type of the region for observation and future periods (under the investigated scenarios studied) was classified under the dry category, with no changes being observed for the future period.

Discussion and conclusion: Considering the growth conditions dominating the Iranian mangroves' habitats in

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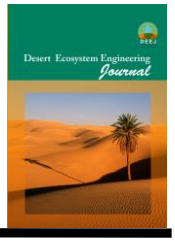

hot and dry regions, the results of the study indicated that compared to other human-induced phenomena, climate change had turned into a serious degradation threat to such habitats. In this regard, the study found that the average temperature would increase in the future, especially during the warm seasons of the year, which in turn may affect the biological and ecological conditions of the mangrove forests of the region. Therefore, a high correlation was found between the changes in mangroves and plant communities of the Khamir and Qeshm region and the changes in drought intensity and temperature increase, indicating that the area of the region's mangrove plant communities has decreased in recent decades due to continued drought. Accordingly, it could be argued that the prospective drought periods would exert considerable influence on the structure of the habitats and the spatial distribution of the mangrove forests. The results of the study also suggested that climate change was considered one of the major known threats to the mangrove forests' Hara biosphere reserve. Therefore, simulating and predicting such changes can provide useful knowledge concerning the trend of temperature and precipitation changes (as the main climatic parameters) in these natural stands, helping to set appropriate measures for preserving and restoring such invaluable biological reserves. Furthermore, in the management plans of this region, climate change can be considered in the region's management plans to reduce the destructive effects of those changes.

Keywords: Climate Prediction, SDSM, Mangrove Forests, Hara Protected Area, Qeshm Island, Khamir Port.